CHAPTER I
INTRODUCTION

1.1. Background

Education has a key role in developing the natural ability of each individual. The vision is to develop a nation's life. One of the most useful skills to be developed during schooling is the set of proficiency enabling pupils to resolve problems. Education is the key sector in which people begin to develop and train their scientific and technical skills to encourage the progress of the development of their talents and abilities (Atta and Aras, 2020). Science becomes a component of education which is predominantly used as a way of achieving an educational goal, as well as developing scientifically literate individuals (Atta and Aras, 2020).

According to Trends in Mathematics and Science Study (TIMSS) in 2015, the comprehension of science is significant for students since they progress toward becoming a twenty-first-century citizen (Jones, Wheeler, and Centurino, 2015). The science comprehension will be achieved from everyday life and the information from many sources, especially from the internet. The ability to filter facts from hoaxes and understanding the scientific basis of crucial social, economic, and environmental issues are possible if they are trained to have the correct mindset since school age (Mun et al., 2015).

Science is knowledge acquired through the process of learning. The learning process involves obtaining data by using the scientific method, inference, or deduction to describe and explain observed signs in nature (Afriana, Permansari, and Fitriani, 2016; Hastuti, Setianingsih, and Anjarsari, 2020; Nugraheni, 2020). Learning science cannot be separated from the ability to apply and incorporate all of the science concepts in daily contexts (Juleha, Nugraha, and Feranie, 2019). This kind of ability is termed scientific literacy (Holbrook and Rannikmae, 2009; Nugraheni, 2020).

Early scientific literacy core values emphasize the learning content (knowledge) and process (procedural) skills. Out there now, the emphasis has shifted to the integration of knowledge and skills required to solve basic and complex real-life issues (Homer and Ryder, 2015; Mun et al., 2015; Sunarya and Mudzakir, 2017). Students must grasp how basic scientific theories can be applied

for seeking solutions to various concerns in the sectors of agriculture, climate, resources, welfare, economy, security, awareness, and many others (Chanapimuk, Sawangmek, and Nangngam, 2018). Scientific literacy can also help students to utilize technology in learning science (Donovan, Green, and Mason, 2014; Ongardwanich, Kanjanawasee, and Tuipae, 2014; Ariska and Rosana, 2020).

The Programme for International Student Assessment (PISA) identifies scientific literacy as the ability to use the useful skills in daily practices. Thus, this ability requires an understanding of science knowledge impacts on human behavior with the environment and its uses to achieve sustainable goals (Nugraheni, 2020). Zhu (2019) stated that PISA had assessed scientific literacy since 2000 until the recent assessment was conducted in 2018. The aim is to enable 15-year-old students to apply relevant knowledge and skills in dealing with various concerns well before completing their compulsory education (Hardinata, Putri, and Permanasari, 2019; Organization for Economic Co-operation and Development, 2015, 2019b).

In the 2015 Science Assessment Framework, PISA covered scientific competencies and attitudes towards science. Scientific competencies reaffirm the need for students to develop the required skills in their future professional lives and to equip themselves with the necessary useful skills in modern civilization (Tsai, 2015). Besides, attitudes towards science have become an equal part of scientific literacy due to the close relationship between competencies and attitudes. PISA 2015 has also identified the red line linking the scientific competence to attitudes towards science (Zhu, 2019).

Indonesian students' trend in scientific literacy has not made any marked improvements over the years. The PISA 2012 data indicated that the Indonesian education system had not met the ideals. Indonesia ranked the 64th out of 65 countries that took part in the assessment. In the next round of assessments in 2015, Indonesia still ranked the same, but out of 72 participating countries. After all, PISA 2015 reported that from 2012, Indonesia caused a remarkable 22.1-point increase in student achievement, which was 382 to 403 in 2015 (Seprianto, Jofrishal, and Mauliza, 2014). In 2018, the outcomes of Indonesian students in science fell to 396, with the OECD average of 489, as the most recent appraisal by PISA (Purwani, Sudargo, and Surakusumah, 2018; OECD, 2019b).

Several studies had conducted scientific literacy research for senior high school students as a sample (Lau, 2013; Seprianto et al., 2014; Purwani et al., 2018). Another study that took undergraduate students as the sample got the result of low achievements of the scientific literacy aspect (Gormally, Brickman, and Lutz, 2012). Besides, the research by Udompong and Wongwanich (2014) and Hacieminoglu (2016) took primary students as the research sample. Several studies had been carried out at the primary, high school, and undergraduate levels. In reference, it is determined in the framework that the students being assessed are middle school students at the age of 15 (OECD, 2016).

Such information implicitly reveals an extensive view of Indonesian education and particularly students who are part of the human resources. Today's generation as future successors of the nation has not met the quality standard in strategies to succeed skillfully on a global scale compared to other countries. Consequently, the issue of the low achievement of scientific literacy among Indonesian students should not be underestimated.

Many potential variables can influence the scientific literacy of students, such as school infrastructures, curriculum, courses, learning strategies, and impacts on society. The other contributing factors are gender, economic, and social (Aldila, Tapilouw, and Sanjaya, 2018).

Research conducted by Nugraheni in 2020, which investigated senior high students' scientific literacy in Biology, showed that boys obtained the highest and lowest results. Such finding departs from Tjalla (2010) that reported higher achievements in scientific literacy among male students (boys) than female students (girls) in Indonesia (Treacy and Melissa, 2011). The discrepancy may have arisen because the measurement of scientific literacy in that other research was restricted in the Biology domain. Ideally, scientific literacy covers all areas of Science, including Technology and Earth and Space (Nugraheni, 2020).

The reason that can be explained behind the conclusion is due to girls tend to spend more time learning science than boys and it results in their better ability to explain scientifically. In most cases, science is closely related to technology, engineering, and math (STEM). Hango (2013) mentioned that girls mostly preferred to be in biology, pure science, health, and medical fields. These career

orientations are seen to have some parts driven from the tendency of students' scientific literacy viewed by gender (OECD, 2017; Putri, Rusyati, and Rochintaniawati, 2018).

In Indonesia, scientific literacy research trends are dominated by the applications of learning that aim to develop students' literacy skills. Science has become the main discipline that dominates scientific literacy researches with junior high school students as a frequently used sample. The most used scientific literacy definition is the definition formulated by PISA with the scientific content domain dominates the assessment (Ni' mah, 2019).

Gormally et al. (2012) developed Test of Scientific Literacy Skills (TOSLS) which are contextualized around real-world problems. The test measures mainly the skills of understanding inquiry methods which result in scientific knowledge and interpreting data to become meaningful information. In another study, Fives, Huebner, Birnbaum, and Nicolich (2014) developed a different kind of scientific literacy assessment instrument called the Scientific Literacy Assessment (SLA). The instrument was created to assess the scientific process, students' motivation, and belief in science.

After figuring out about the current urgency of scientific literacy, this research aims to portrait the scientific literacy possessed by students in junior high school levels. By these aims, the development of an instrument for testing scientific literacy should be made. By the research, the subject chosen was natural science. It is also interesting to verify the gender bias in scientific literacy, as those who have investigated it. The research findings will be used as a basis to design mutual science learning that can be implemented to build and increase the scientific literacy of students and are also expected to be one of the primary references for formulating the next steps to develop scientific literacy whether for educational purposes or not.

1.2. Research Problem

Based on the previous explanation in the background, the research problem of this research is ''How is the profile of scientific literacy of junior high school students in Natural Science Subject?''

1.3. Research Question

As an elaboration of the research problem, the research attempts to explore the following questions:

1) How is the profile of junior high school students' scientific literacy in Natural Science subjects?
2) How is the profile of junior high school students' science proficiency level in Natural Science subjects?
3) How significant is the difference between students' gender and students' scientific literacy?

1.4. Limitation of Problem

The restrictions on research problems are deemed in any way, as follows, to give reliable outcomes.

1) Students' scientific literacy refers to the scientific literacy achievement of junior high school students in Natural Science subjects as defined by the National Curriculum. Scientific literacy consists of three aspects which are scientific competencies, scientific knowledge, and attitudes toward science. Those are delivered in personal, national, and global contexts.
2) Students' science proficiency level refers to the scale of students' scientific literacy results for the substantive interpretation. The scale ranges from Level 1 up to Level 5. The proficiency levels include the range of ability in terms of scientific competencies and scientific knowledge.
3) The themes used in the test are taken from the subject matters in Natural Science Subject. Then, the themes are delivered in various contexts. Natural Science Subject is the integrated science course in junior high school level in Indonesia. The subject matters used in the test are mostly taken from 7^{th} and 8^{th} grade. Those are the Substances and Their Characteristics, Temperature and Heat, Energy, Interaction between Living Things, Pressure, Environmental Pollution, Climate Change, Respiratory System, Excretion System, Solar System, and Science and Technology.
4) In this research, gender classification used is boys and girls who are officially registered as ninth grade junior high school students.

1.5. Research Objective

1) To profile the junior high school students' scientific literacy in Natural Science subjects.
2) To profile the junior high school students' science proficiency level in Natural Science Subject.
3) To investigate the difference between students' scientific literacy and students' gender in Natural Science subjects.

1.6. Research Benefit

The results of this research are expected to give beneficial contributions to many parties as follow:

1.6.1. For students

The results may assert their level of scientific literacy and may also motivate them to develop their science literacy threshold in science learning. After having been concerned and informed of their level of scientific literacy, students can assess themselves to assist them to go through the science subject that encourages the government's determined educational goals at the end of primary education.

1.6.2. For teachers

This research is intended to be a contribution and an overview of middle school students' scientific literacy. To promote the progress of scientific literacy, teachers are expected to develop new approaches or ideas centered on scientific literacy and to provide meaningful teaching-learning experiences in the classes.

1.6.3. For researchers

This research aims at contributing to the improvement of the students' scientific literacy in the Natural Science Subject. Other researchers may also use the data as reliable information and as a recommendation for future studies. Many types of research may also identify the strengths and limitations of this research as the study developed the instrument, which may help to promote improved studies in this research area.

1.7. Organizational Structure of Research Paper

Five chapters compose this research paper, starting from Chapter I to Chapter V. Chapter I is titled Research Introduction. The introduction discusses the research background, its research problem, research questions, problem limitations, research objectives, and expected benefits of research. Chapter II is the Literature Review. This chapter describes all the necessary details of the ideas being discussed in this study. Previous works are reviewed to unravel the theoretical underpinnings of this study. Chapter III is the Methodology of Research. This chapter features prominently in research, starting with its method, design, population and sample, and in particular written descriptions of the development of the research instrument.

Chapter IV is the Result and Discussion. It contains the results of collected data as well as the proper data analysis procedures being employed to determine the results. After obtaining the results, discussions are carried to communicate the results of data analysis, which are mostly numbers, by using words to enrich the findings, as they can be in form of review with the related previous studies. Last but not least, Chapter V is the Conclusion and Recommendation. This chapter concludes detailed descriptions of a variety of major ideas that are perceived to be the most noteworthy points of the research. Recommendations are written as the medium for evaluating the strengths and limitations of this research to make many improved studies.